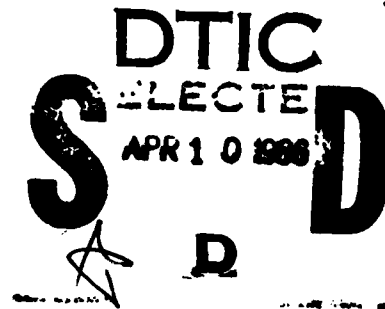# PROPAGATION SIMULATOR ENHANCEMENT PROGRAM

E. Cross
General Electric Company
Space Division
Valley Forge Space Center
P. O. Box 8555
Philadelphia, PA 19101-8555

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1 May 1985

Technical Report

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Prepared for
    Director
    DEFENSE NUCLEAR AGENCY
    Washington, DC 20305-1000

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| 24 | 14 | | Delay Lines |
| 9 | 1 | | Frequency Translators |

**19. ABSTRACT (Continue on reverse if necessary and identify by block number)**

The DNA Propagation Simulator was designed and fabricated by General Electric Company to simulate in hardware the propagation disturbance in a transionospheric radio link caused by a high-altitude nuclear detonation. Under Contract DNA 001-83-C-0109, General Electric Company added several enhancements to the DNA Propagation Simulator, including incorporation of the VAX 11/730 computer, automatic adjustment of the mean power profile, additional delay lines with 40 and 80 nanosecond tap spacing, and L-and S-Band frequency translators. Field support was also provided to users of the simulator. This final technical report summarizes the achievements of this enhancement program.

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|---|---|---|
| Betty L. Fox | (202) 325-7042 | DNA/STTI |

**DD FORM 1473, 84 MAR**  83 APR edition may be used until exhausted. All other editions are obsolete.

# TABLE OF CONTENTS

Accesion For

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DTIC  TAB        ☐
Unannounced      ☐
Justification ...................

By ...............................
Dist.ibution /

Availability Codes

Dist | Avail and/or
     | Special

A-1

QUALITY
INSPECTED
3

## LIST OF ILLUSTRATIONS

# SECTION 1
## SCOPE

General Electric Company's effort on Contract DNA 001-83-C-0109, Propagation Simulator Enhancement Program, is now complete. This report summarizes the achievements of this program, including completion of the tasks specified in the contract and additional effort necessary for effective program execution. Figure 1 illustrates the major changes to the Propagation Simulator hardware which have occurred over the last two years. The simulator now stands ready to support a wider range of test scenarios with increased versatility and convenience, due to the incorporation of a VAX 11/730 computer. This report concludes with recommendations for additional improvements which will make the propagation simulator an even more effective research and development tool.

Figure 1. Enhanced DNA propagation simulator.
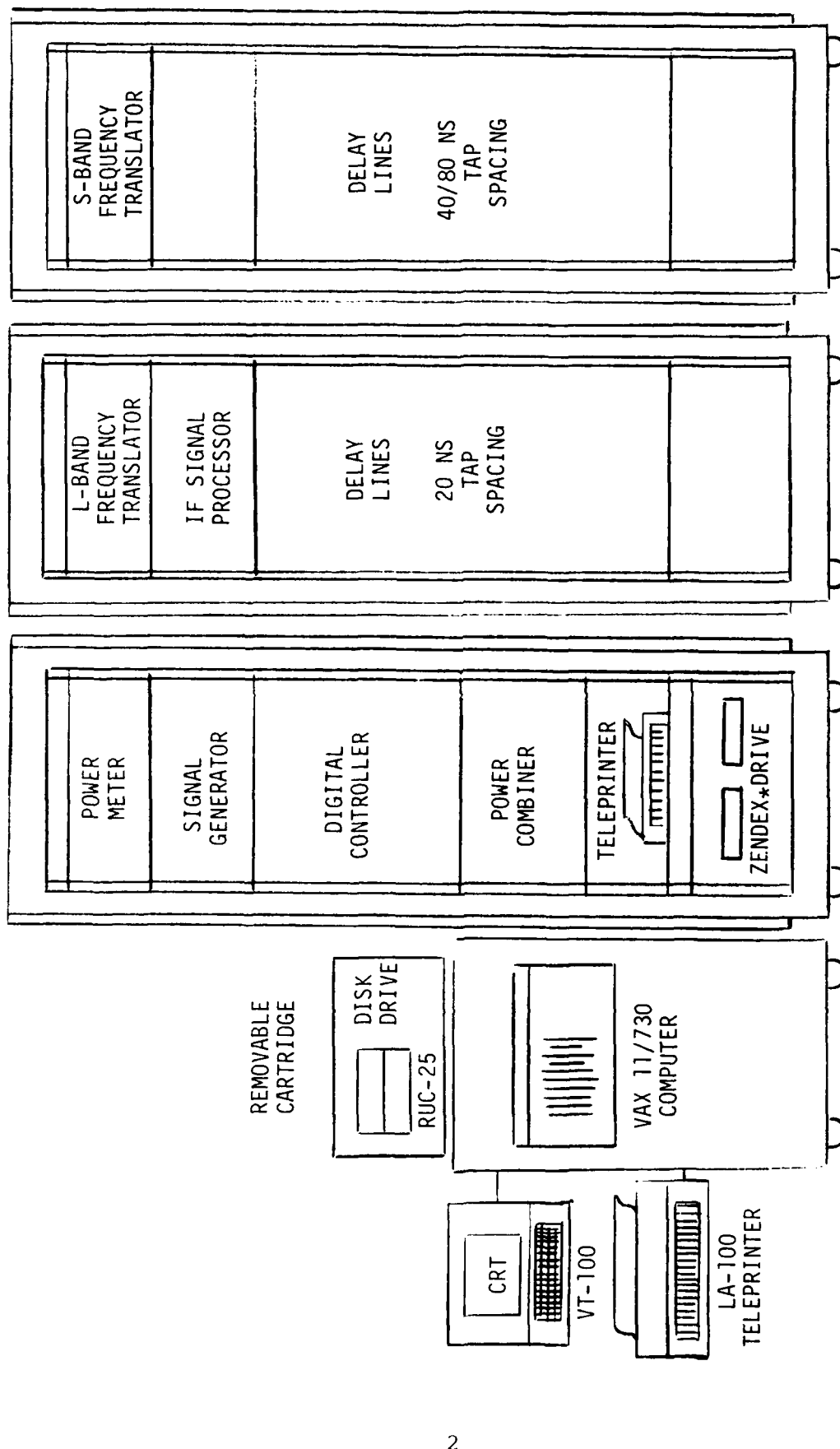
* TEMPORARY. WILL BE REMOVED WHEN VAX SHIPPED WITH SYSTEM.

2

# SECTION 2

## TASKS SPECIFIED

The following paragraphs summarize the work accomplished as specified in Tasks 1 through 9 of Contract DNA 001-83-C-0109:

A.  TASK 1: AUTOMATIC MEAN POWER PROFILE

In order to utilize the full dynamic range of the simulator's vector modulators, it is necessary to adjust attenuators at each delay line tap to match the marginal delay power density (MDPD) profile corresponding to the selected decorrelation bandwidth (fo). In the past, the MDPD profile was computed off line and attenuator pads were manually inserted at each tap. This manual process was required each time a new fo was selected.

The simulator's off-line data generation software was modified to permit automatic adjustment of the mean power at each tap. It was found that the vector modulators has a dynamic range of approximately 50 dB rather than 40 dB specified. With this additional range, it was shown that each of the taps within 0.6/fo can be commanded throughout their required 40 dB range. Assuming that energy outside 0.6/fo is negligible, the software implementation was found to be effective. Confidence level, Chi-square, and Graham-Charlier analysis showed the implementation to be consistent with required Rayleigh statistics. It is now possible to operate with any fo from 630 KHz to 6.2 MHz without manually changing the attenuator pads at each delay line tap.

B.   TASK 2: AVERAGE POWER OUTPUT MEASUREMENT

This capability was deemed unnecessary and the task was deleted by direction of the Contract Technical Monitor.

C.   TASK 3: S-BAND FREQUENCY TRANSLATOR

A frequency translator operating in the 2.2 GHZ to 2.3 GHz band was designed, fabricated, and tested. This unit adapts the translator's 700 MHz operating frequency to that required by a specific user of the equipment. Figure 2 is a block diagram of the S-Band Frequency Translator. It accepts high-level (0 dBm) or low-level (-60 dBm) inputs, and provides simultaneous high- and low-level outputs. The simulator's built-in HP-8656A synthesized signal generator is used to provide a tunable local oscillator. The S-Band Frequency Translator is installed in the RF rack adjacent to the IF Signal Processor.

D.   TASK 4: DELAY LINE RACK:

A single-bay rack containing 48 delay elements with selectable 40 or 80 nanosecond spacing was designed, fabricated and tested. The configuration is similar to the previously fabricated delay line assembly which has 20 nanosecond delay element spacing. Sections of semi-rigid coaxial cable are cut to precise lengths to achieve the necessary delay, and equalized amplifiers are used in each section to compensate for frequency-dependent losses over the 100 MHZ passband of the lines. Figure 3, which shows a delay line section, illustrates the method used to switch between 40 and 80 nanosecond spacing. This switchover can be accomplished easily in the field without the need for recalibration. Performance of the delay line assembly has been evaluated using an automatic network analyzer. Figure 4 is a sample of test data taken. Net gain of the entire 48 sections of delay line, in either the 40 or 80 nanosecond configuration, is 0.5dB.
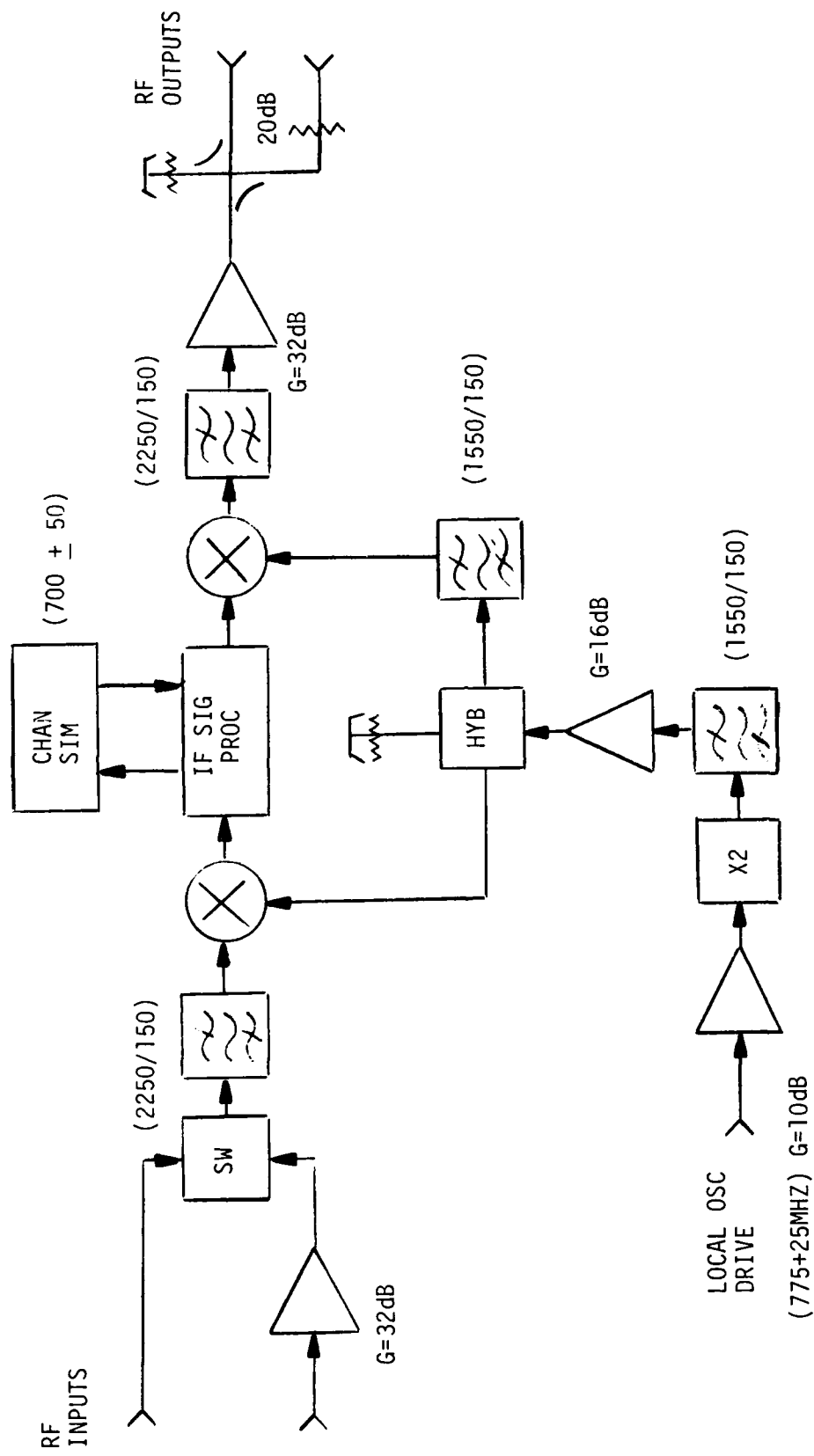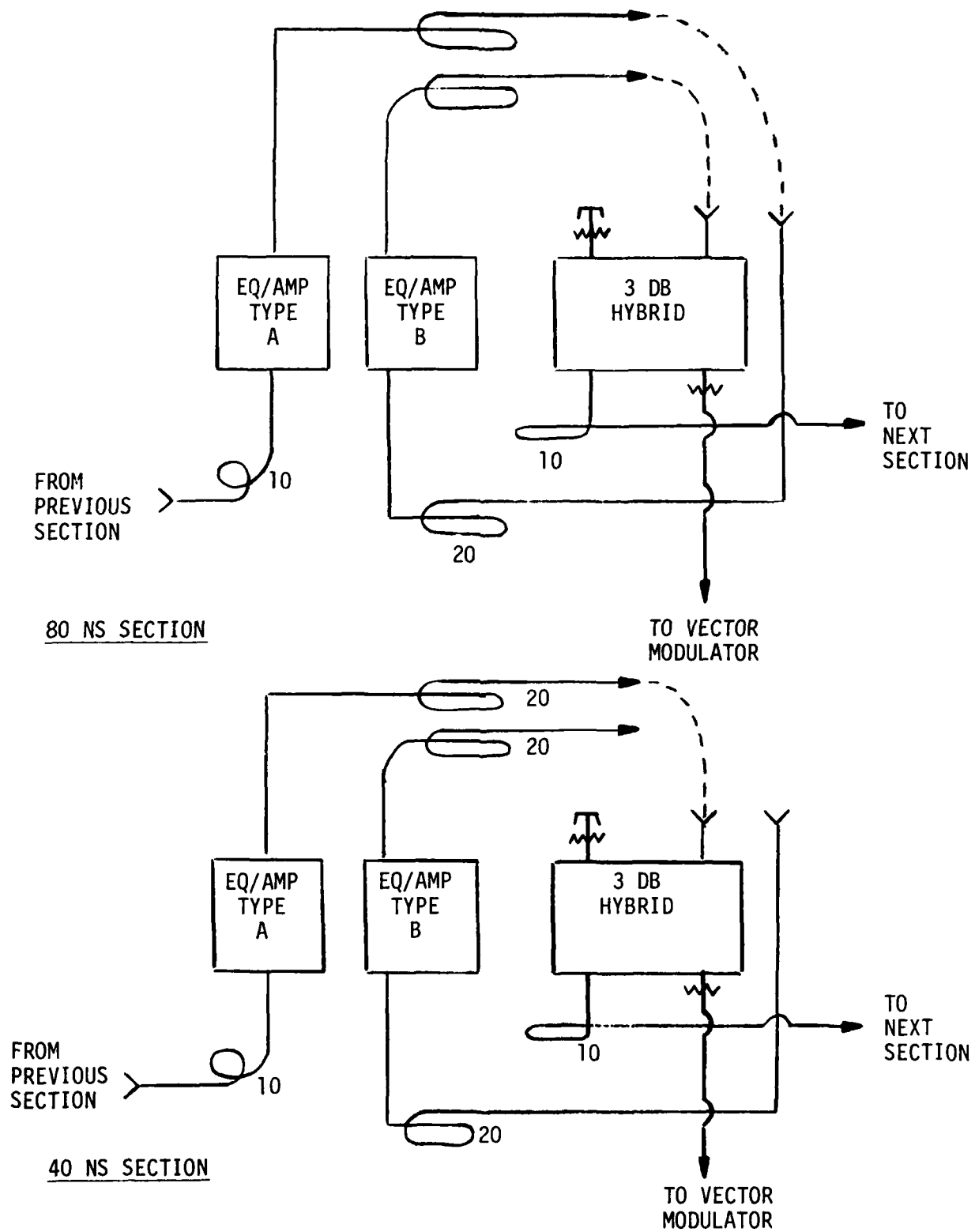
4

Figure 2. S-band frequency translator.

**80 NS SECTION**

**40 NS SECTION**

Figure 3. Delay line reconfiguration.

6

**40ns TAP 21**

| FREQ. MHZ | RETURN LOSS INPUT (S11) DB | DEG | TRANS LOSS FORWARD (S21) DB | DEG | TRANS LOSS REVERSE (S12) DB | DEG | RETURN LOSS OUTPUT (S22) DB | DEG | ENVELOPE DELAY NANOSEC |
|---|---|---|---|---|---|---|---|---|---|
| 650.000 | 26.1 | -61.8 | .2 | -86.9 | 71.1 | -171.7 | 32.8 | 139.2 | 393.7 |
| 675.000 | 27.4 | -60.6 | .2 | 71.3 | 70.7 | -130.6 | 33.1 | 142.8 | 394.5 |
| 700.000 | 25.7 | -82.9 | .0 | -130.3 | 65.5 | 34.2 | 32.0 | 134.9 | 394.5 |
| 725.000 | 26.0 | -85.5 | .1 | 24.3 | 72.6 | 121.0 | 31.6 | 140.9 | 397.1 |
| 750.000 | 25.2 | -103.4 | .1 | -166.6 | 74.9 | -59.3 | 31.7 | 133.1 | 399.6 |

**40ns TAP 22**

| FREQ. MHZ | RETURN LOSS INPUT (S11) DB | DEG | TRANS LOSS FORWARD (S21) DB | DEG | TRANS LOSS REVERSE (S12) DB | DEG | RETURN LOSS OUTPUT (S22) DB | DEG | ENVELOPE DELAY NANOSEC |
|---|---|---|---|---|---|---|---|---|---|
| 650.000 | 26.1 | -62.8 | .2 | -179.6 | 76.2 | 73.5 | 26.6 | 169.7 | 438.7 |
| 675.000 | 25.5 | -59.7 | .0 | -38.9 | 68.0 | -43.3 | 26.7 | 169.0 | 436.5 |
| 700.000 | 25.7 | -83.2 | -.2 | 102.1 | 62.9 | -35.1 | 26.4 | 168.2 | 436.5 |
| 725.000 | 26.0 | -84.6 | -.1 | -80.2 | 70.5 | 135.0 | 26.0 | 166.9 | 434.1 |
| 750.000 | 25.2 | -103.7 | -.1 | 33.8 | 68.9 | -109.7 | 26.3 | 165.5 | 437.6 |

**40ns TAP 23**

| FREQ. MHZ | RETURN LOSS INPUT (S11) DB | DEG | TRANS LOSS FORWARD (S21) DB | DEG | TRANS LOSS REVERSE (S12) DB | DEG | RETURN LOSS OUTPUT (S22) DB | DEG | ENVELOPE DELAY NANOSEC |
|---|---|---|---|---|---|---|---|---|---|
| 650.000 | 26.1 | -62.8 | .2 | -136.4 | 74.1 | 142.0 | 47.2 | -127.8 | 477.7 |
| 675.000 | 27.5 | -59.8 | -.0 | -14.7 | 74.7 | -132.7 | 42.5 | -116.7 | 478.5 |
| 700.000 | 25.7 | -83.1 | -.1 | 106.7 | 66.4 | -150.7 | 48.6 | -156.8 | 483.5 |
| 725.000 | 25.9 | -91.0 | .0 | 54.0 | 70.6 | -100.0 | 41.1 | -148.1 | 493.1 |
| 750.000 | 25.2 | -103.6 | .0 | 1.4 | 70.3 | 10.0 | 46.2 | -169.0 | 479.6 |

Figure 4. Delay line performance data.

E.   TASKS 5-7: FIELD SUPPORT

The DNA Propagation Simulator was used to conduct tests at Buckley National Guard Base, Colorado, from July to December 1983 and at Texas Instrumants, Dallas, Texas, from September to December 1984. Field support provided at each test site included the following:

(1) Initial meeting with users to define test setups and parameters and to discuss installation details.

(2) Generation of simulation files from test parameters supplied by users.

(3) Install, calibrate, and checkout the simulator at the test site.

(4) Make minor modifications, as required, to insure proper interfacing with user equipment under test.

(5) Train user personnel in simulator operation.

(6) Provide continual maintenance support of the simulator during the test period.

Tests at both the Colorado and Texas sites were successful, and the simulator operated well throughout the test periods.

F.   Task 8: STAND-ALONE SIMULATOR

This task was intended to eliminate the Propagation Simulator's dependence on external computer equipment. A VAX-11/730 computer system was procurred and integrated with simulator to provide necessary processing. This system includes a Model RUC-25 disk drive (52 megabits, total capacity), a VT-100 CRT terminal, and a LA-100 teleprinter. Software programs formerly run on the VAX-11/780 time-shared system at General Electric Co, including the CIRF program, have been transferred to the VAX-11/730. Data communications between the VAX-11/730 and the simulator's Digital Controller can be provided by a direct RS-232

8

interface cable, or alternately, via telephone lines if modems are provided.

## G. TASK 9: L-BAND FREQUENCY TRANSLATOR

A frequency translator which enables the Propagation Simulator to operate with NAVSTAR Global Positioning System (GPS) equipment was designed, fabricated, and tested. Three simultaneous L-band frequencies (1227.6MHz, 1381.05MHz and 1575.42MHz) are translated to operate in a 50 MHz intermediate frequency passband centered on the 700 MHz operating frequency of the simulator. Figure 5 is a block diagram of the L-Band translator. In operation, all three L-Band signals simultaneously experience the frequency- selective fading channel characteristics developed by the simulator. The translator accepts inputs and provides outputs at low level (-80dBm) or high level (0 dBm). Front panel connectors are provided for monitoring input and output signals. The L-Band Frequency Translator is installed in the RF Rack adjacent to the IF Signal Processor.
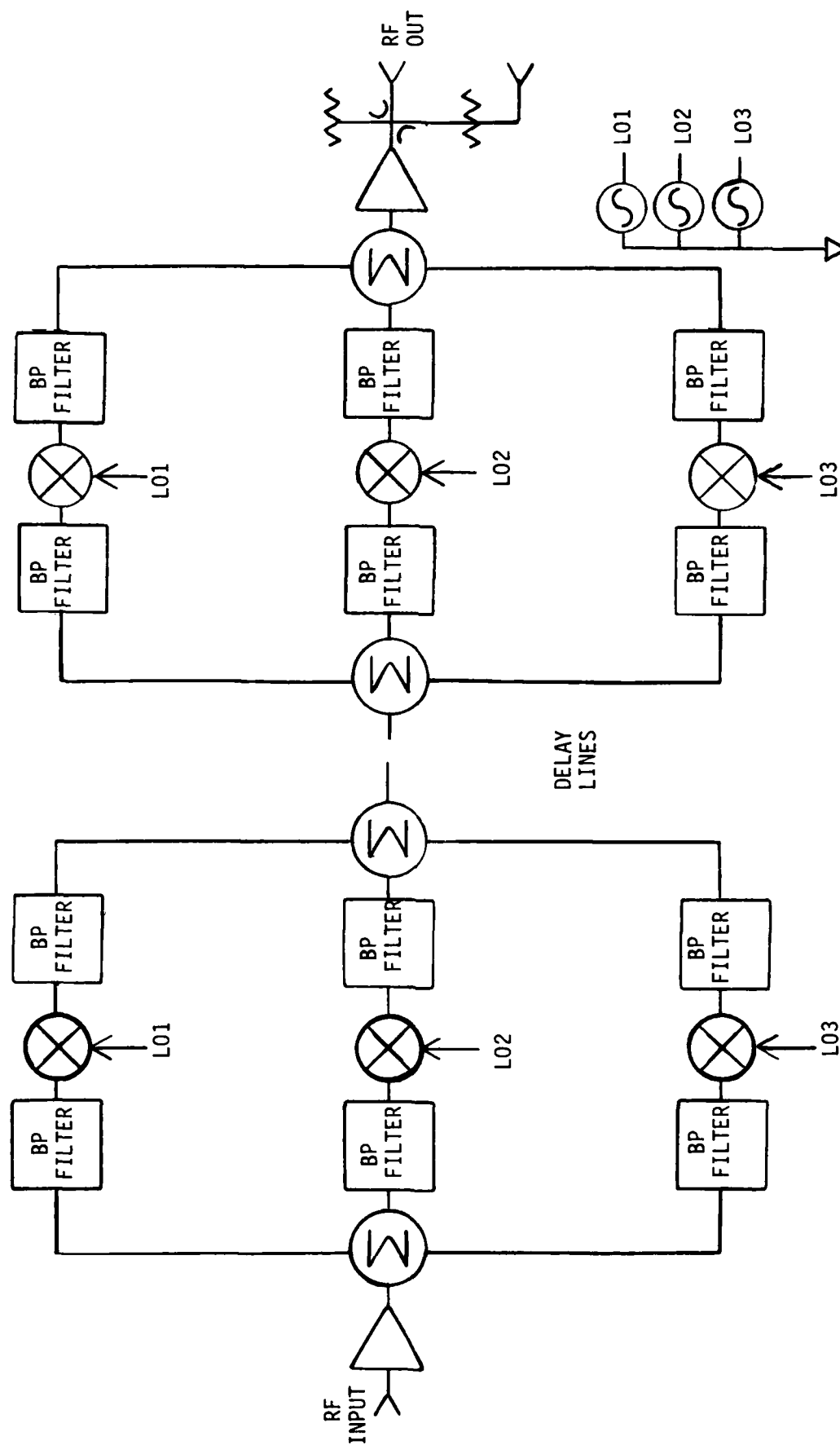
Figure 5. L-band frequency translator.

# SECTION 3
## ADDITIONAL ACCOMPLISHMENTS

Incidental to providing field support and equipment modifications specified in contract DNA 001-83-C-0109, additional effort was necessary to eliminate problems identified in the field and prepare for future support requirements. A summary of these tasks is as follows:

### A.  SELF-TEST:

When the simulator was sent to field sites, means for evaluating its principal components was generally not available. To solve this problem, a Self-Test firmware program was developed and installed in the Digital Controller. Using only the simulator's internal test equipment, the Self-Test program measures the independent contribution of each delay line tap when the vector modulator I and Q channels are driven into each phase quadrant. The Self-Test program evaluates all 48 taps in less than one hour, and provides a clear indication of defective components such as vector modulators, hybrids, equalizer- amplifiers, power combiners, and digital-to-analog converters.

### B.  DIGITAL RACK RECONFIGURATION:

With the addition of the VAX-11/730 computer, the need to make more efficient use of rack space became apparent. The Digital Controller, which formerly occupied two card cages, was reinstalled in a single compact card cage. A new panel for mounting power combiners was fabricated to provide better access to connectors when performing equipment calibration. The power meter, signal generator, Digital Controller, and combiner panels were mounted in a single rack. Temporarily, the original teleprinter (Silentwriter 700) and diskette drive (Zendex) have also been installed in this rack. It is therefore possible to supply a two-rack simulator configuration to the field while the VAX-11/730 remains in plant to support additional software enhancements. When the VAX-11/730 is shipped to the field with the simulator, the Silentwriter 700 and Zendex drive will be eliminated. Figure 1 illustrates the new digital rack configuration.

11

C.  CLASSIFIED PROCESSING:

Noting the customer's desire to run the classified SIGDAT program in the VAX-11/730, an investigation of related security issues was conducted. Should it be specified at a later date, the steps required to establish TEMPEST protection have been compiled.  Procedural requirements for classified processing have been extracted from DOD 5220.22-M (Security Requirements for ADP Systems), and a prelimary outline for an ADP Standard Practice Procedure (SPP) have been prepared.  An SSP for the Propagation Simulator must be approved by the Defense Investigative Service before the equipment can be used for classified data processing at a contractor facility.  Appendix A (attached herewith) addresses in detail the issues associated with running classified software on the Propagation Simulator computer.

D.  SOFT START:

When the simulator is used to evaluate a modem, the transients caused by switching the simulator on can cause the modem to lose synchronization.  A technique was developed <u>and</u> <u>implemented</u> which <u>will</u> allow the simulator to be activated during an interval of minimal perturbation.

# SECTION 4
## RECOMMENDATIONS

Many new ideas for improving the simulator's effectiveness have been logged over the last two years. The following improvements are recommended because they would add substantially to the simulator's capabilities while requiring only a modest investment:

A. The Digital Controller, which is based upon the 8086 microprocessor, lacks the capacity to process multiple simulation files. Providing the Digital Controller with a new CPU board and additional memory would remove this hardware limitation.

B. Software algorithms for the VAX 11/730 are required to handle multiple files. Special emphasis must be placed upon the period of transition between files to prevent discontinuities from adversely affecting fading statistics.

C. A minor hardware change in the IF Signal Processor could provide a port for injecting a jamming signal from an external source.

D. The additional capacity of the VAX 11/730 is available to drive a large number of external test instruments via the General Purpose Interface Bus (IEEE 488). Software could be developed to fully automate entire test setups.

E. A programmable attenuator under software control can be added to the IF Signal Processor to simulate atmospheric absorption effects.

14

# APPENDIX A
## RUNNING CLASSIFIED SOFTWARE ON THE DNA
## PROPAGATION SIMULATOR COMPUTER

## 1. BACKGROUND

The SIGDAT is a program contained in the technical report DNA-IR-82-01 entitled "A Reasonable Worst Case Specification Of Nuclear Disturbed-Radio Signals." T he SIGDAT program is written in FORTRAN and contains a data base which is classified SECRET. The program generates $\tau_o$ and fo parameters, which are unclassified, for various selected nuclear event scenarios. In the past, GE has been furnished ( $\tau_o$, fo) data for subsequent unclassified processing.

## 2. REQUIREMENTS:
The basic requirement is to determine what steps must be taken to enable propagation simulator users to run the classified SIGDAT program on the associated VAX 11/730 computer. Implicit in this requirement is the examination of physical security, TEMPEST, and procedural issues which affect our compliance with applicable security regulations, policies,and guidelines.

## 3. ASSUMPTIONS:
This analysis is based upon the following assumptions:

A. SIGDAT is the only classified program which will be run in this equipment.

B. The Propagation Simulator will be used only in Government or contractor facilities having controlled access. (The test data taken will normally be classified).

C. NSA specification NACSIM 5100B will be the primary source of TEMPEST and red/black engineering criteria.

D. DOD 5220.22-M, Security Requirements for AD% Systems, will be the primary source of procedural requirements for classified data processing.

4. PHYSICAL SECURITY: Measures must be taken to prevent intentional or accidental removal of classified information from the equipment by physical means. The following areas are susceptable to physical compromise:

A. A magnetic tape cassette is used to boot the VAX-11/730 computer during the initial power-up process. The cassette tape drive is located on the CPU front panel. This tape must be removed from the tape drive before beginning classified processing to preclude the possibility of receiving and retaining classified information.

B. The RUC25-BA disk drive includes one 26 MB fixed disk. Regardless of whether or not this disk is addressed in the course of classified processing, the possibility that classified information could be transferred to this disk must be assumed. After classified processing is complete, an erasure program specified in DOD 5220.22M must be run to purge this disk of all data.

C. The RUC25-BA disk drive includes one 26 MB removable disk cartridge. It is assumed that the classified SIGDAT program, and other information, will reside in this cartridge. After classifed processing, this cartridge must be removed from the drive and stored in an approved secure container. When unclassified processing is performed a separate disk cartridge must be used.

D. The VAX 11/730 registers/buffers must be cleared after classified processing. This can be done by briefly turning off AC power.

E. The hard copy output of the teleprinter associated with the VAX-11/730 may include classified information derived from the SIGDAT program. This paper must be properly safeguarded.

F. The area in which the system is operated must be properly controlled to prevent unauthorized viewing and removal of hardware, magnetic media, and hardcopy material containing classified information. DOD 5220.22M outlines procedures for these safeguards.

5. <u>SIGNAL</u> <u>EMANATIONS</u>: Measures must be taken to prevent the interception of compromising emanations radiated from the hardware or conducted by its power and signal cables. The following areas are considered TEMPEST hazzards.

A. The current VT100-AA terminal is not equipped with RFI shielding suitable for TEMPEST protection. This CRT terminal is the source of the most severe radiated emissions.

B. The current LA100-BA teleprinter is the next most severe source of radiated/emissions.

C. The current housing for the VAX 11/730 CPU and RUC 25-BA disk drive are not equipped with RFI shielding suitable for TEMPEST protection. Necessary protection can be provided by installing this equipment in a properly shielded enclosure, and thoroughly testing for TEMPEST integrity.

D. The AC power cables serving the computer and peripheral equipment are source of conducted emanations. Installation of suitable filters can reduce this vulnerability

E. The signal cables connecting the VAX-11/730 computer to the Propagation Simulator Digital Controller are used only during unclassified data processing. They are not required when running the classified SIGDAT program. However, the possibility that classified information could be transferred to these cables must be assumed. If these cables remain in place during classified processing, then all the Propagation Simulator racks must be considered to contain red signals and thus be subject to TEMPEST considerations. This source of conducted emanations can be eliminated by removing these cables during classified processing and capping the connectors with properly shielded terminators.

6. <u>DEGREES</u> <u>OF</u> <u>PROTECTION</u>: There is no possibility of absolute protection from hostile interception of compromising emanations. Various degrees of protection are feasible, depending upon the economic investment in protective measures. The using agency should seek a balance between probability of intercept and cost for each of the countermeasures

17

considered. There appear to be three levels of TEMPEST protection which can be achieved for the Propogation Simulator:

A. The lowest level, which may nevertheless be adequate, entails placing the existing equipment in a facility which minimizes the possibility of signal interception. While complete RFI screening is ideal, other less costly precautions can be taken. The equipment can be placed as far inside the controlled area as possible to minimize the effectiveness of a ferret (hostile interceptor). It is also necessary to apply sound equipment grounding practices. Security organizations commonly authorize SECRET-level data processing in systems which are not TEMPEST certified.

B. The next level of protection, requiring only a modest investment, entails replacing the VT 100-AA terminal and LA100-BA teleprinter with a single off-the-shelf TEMPEST-certified teleprinter. These units represent substantially greater sources of radiated emissions than the computer itself. A variety of suitable teleprinters are cited in NSA's listing of preferred TEMPEST products.

C. The highest level of protection, requiring a substantial expenditure for hardware and testing, is obtained by installing the VAX-11/730 and RUC25-BA in a special shielded cabinet as well as providing a TEMPEST-certified teleprinter. The nonrecurring engineering and testing expenses for achieving a certifiable TEMPEST system could conceivably exceed the cost of a new TEMPEST-certified system from the computer vendor. This approach attempts to render the system invulnerable to interception independently of any protection the facility might provide.

7. ADP STANDARD PRACTICE PROCEDURE: The defense investigative service (DIS) is responsible for establishing and enforcing security requirements at the facilities of defense contractors. Before classified software can be run in a computer, the contractor must have an ADP Standard Practiced Procedure (SPP) prescribed by DOD 5220.22-M and approved by DIS. Appendix B is an outline for preparing an SPP. A separate SPP is required for each computer system so used. Normally an SPP is written for a specific

facility, but with DIS approval, it should be possible to prepare a plan sufficiently general to be applicable to any contractor's plant.

8.    MILITARY SECURITY REQUIREMENTS: When the simulator is shipped to military installation and classified processing is required, authorization from the security organization serving that activity will be required. The DIS-approved SPP may be accepted by the organization, but coordination well in advance of the scheduled test support is essential.
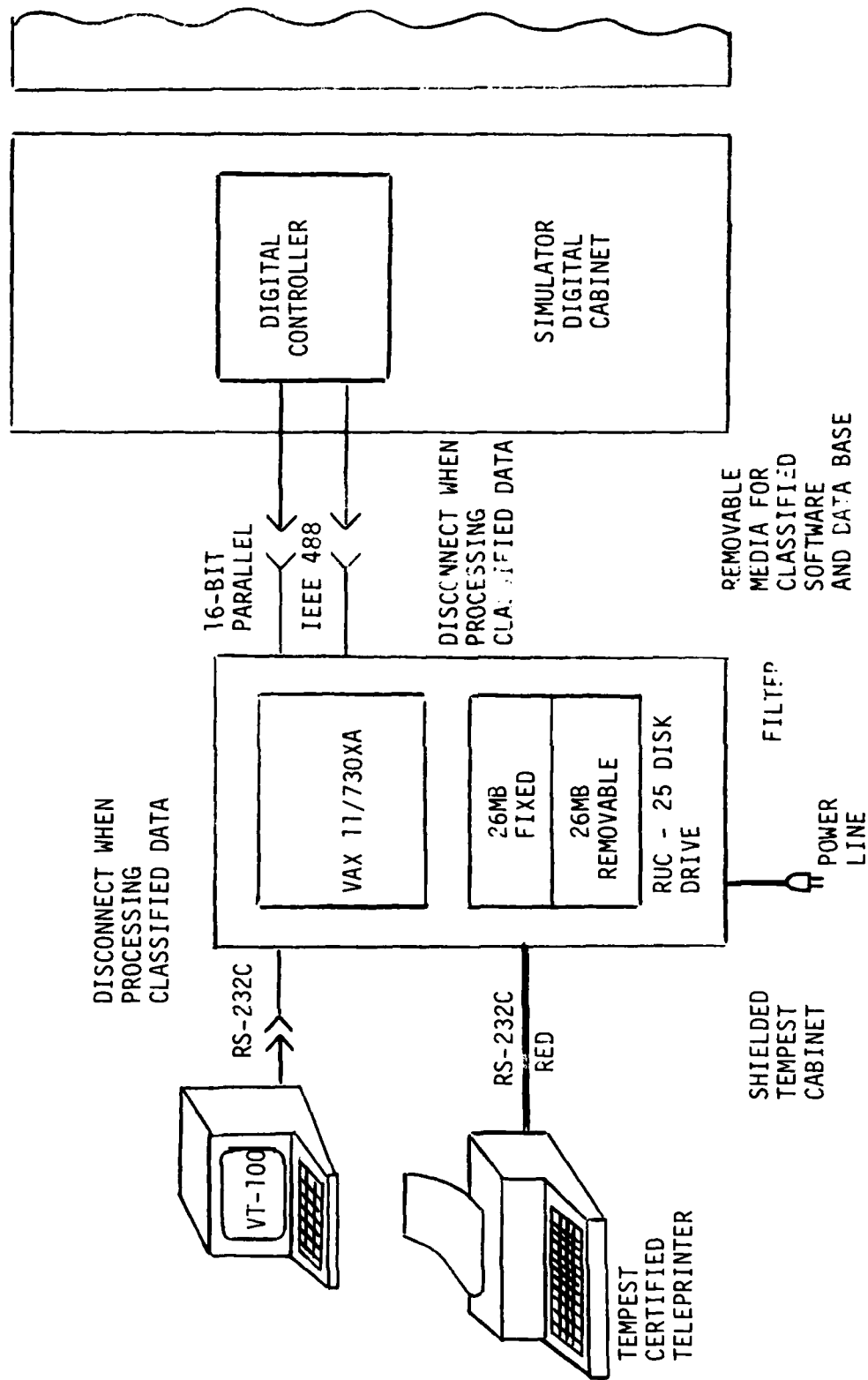
DIGITAL CONTROLLER

SIMULATOR DIGITAL CABINET

16-BIT PARALLEL

IEEE 488

DISCONNECT WHEN PROCESSING CLASSIFIED DATA

REMOVABLE MEDIA FOR CLASSIFIED SOFTWARE AND DATA BASE

FILTER

VAX 11/730XA

26MB FIXED

26MB REMOVABLE

RUC - 25 DISK DRIVE

POWER LINE

DISCONNECT WHEN PROCESSING CLASSIFIED DATA

RS-232C

RS-232C

RED

SHIELDED TEMPEST CABINET

VT-100

TEMPEST CERTIFIED TELEPRINTER

Figure 6. Tempest protection for propagation simulator computer.

20

# APPENDIX B
## OUTLINE FOR ADP STANDARD PRACTICE PROCEDURE


IDENTIFICATION


Contractor facility name, address, and Federal Supply Code Number.

General description of computer system (s) used for classified processing (i.e., system name, manufacturer, model, type, etc.).

Physical location of central computer facility (i.e., complex, building, level, area, post, room, etc.).

Name (s) and telephone number (s) of ADP system security supervisor and ADP system security custodian (s). (Para 103c)

ADP system security mode of operation. (Para 112c(1)

Highest level of classified information processed.


SUMMARY OF SYSTEM USAGE (Para 112c(5)(b))


Classified use or purpose of system (i.e., word processing, graphics display, real-time calibration, simulation, etc.). Indicate local and remote utilization capabilities.

Approximate percentage of total system utilization used for classified processing.

Hours/shifts of system operation, and hours/shifts when classified processing may occur.

Run schedule mix during classified processing, i.e., what classified/ unclassified applications processed concurrently.

Type and general uses of storage and input/output media used during classified processing. Indicate highest security classification of each.

Glossary of frequently used terms and acronyms related to the system or facility.


HARDWARE (PARA 112C(3))


List all system equipment (local and remote), including memory storage units, by device name, model, manufacturer, and serial number,

21

if appropriate.

Identify those devices used during classified processing periods.

Diagram (s) or floor plan (s) indicating placement of above equipment in the facility (identify building, area, room, etc.).

Schematic diagram of hardware configuration and equipment interfaces (i.e., cable connections, channel assignments, etc.).

Channel assignments for subsystem and peripheral equipment.

Disconnect methods (i.e., logical, physical, system generation, etc.) for peripheral and shared devices not used during classified processing.

Switching devices, not included in equipment described above, for channels, peripheral devices and remote terminals.

If patch boards used in classified processing, how used and protected (also patch board diagrams).


SOFTWARE (Para 112c(3))


Operating System (O/S)

Name and release level of dedicated, protected O/S used for classified processing.

Specify whether O/S is standard or locally modified.  If modifications affect security features of the O/S briefly describe.  (Para 112c(5)(d)

Who maintains and generates the O/S?  Are recertification tests conducted periodically, after system malfunctions, and after scheduled/ unscheduled hardware or software maintenance/modification?  Are program changes controlled, recorded, approved and tested by responsible authority?

Describe test and verification procedures. (Para 112c(5)(h)

O/S logging features used during classified processing periods.

Security/protective features available in the O/S (i.e., memory protection, passwords, user/privilege mode, file protect, read/write protect, etc.).  Indicate those features used during classified processing periods.

Control and clearing procedures for "paging" (virtual storage).

If "checkpoint restart" used during classified processing, how checkpoints protected?  Checkpoint values purged when no longer of value? Can application programs access the checkpoint file?

22

Application Software (classified processing)

Generation, maintenance, testing, documentation and control of classified application programs. (Para 112c(5)(h)

Security enhancements written into application programs and programs developed to supplement security/protective features of the O/S. (para 112c(5)(d)

To what extent, under what conditions, and from which locations is interactive programming/debugging allowed.

Programming logic employed for logical disconnects, redundancy checks, and external verifications.

Programming languages used.


## TELEPROCESSING

Total teleprocessing system (s) employed. For those systems not used during classified processing, indicate disconnect method(s). (Para 107c) For those teleprocessing systems used during classified processing periods:

Schematic diagram or description of teleprocessing configuration and communications interfaces (i.e., controllers, modems, multiplexors, channel couplers, data code converters, communications subsystems, etc.).

Type of remote I/O devices and general usage of each (i.e., portable, stationary, intelligent, keyboard, CRT, printer, card reader, analog, batch, interactive, etc.).

Type of communications circuits to central computer facility (i.e., dial-up, dedicated, wirelines, fiber optics, etc.). (Para 109)

Classified information protected by CRYPTOGRAPHIC communications circuits or hardened lines. If latter, describe installation, physical protection and line surveillance. (Para 109 and 112c(4))

Message verification procedures and routing control methods used.

Procedure if remote terminals used to modify classified parameters (data, program, or passwords).


## PERSONNEL (Para 105)

Personnel access controls to central computer facility and remote terminal areas during working and nonworking hours. (Para 112c(2) and 112c(5)(c))

System users (Para 105a)

23

System support personnel (Para 105b)

Visitor controls and escorting procedures (Para 105c and 112c(5)(j))

Security education program for system personnel (ie., briefings, how
and where records maintained, etc). (Para 105d and 108d)

## PHYSICAL (Para 106)

Describe physical safeguard characteristics of the areas where equipment
and material is located (i.e., central computer facility, terminal areas,
media library, communications center, etc.). Include descriptions of walls,
doors, windows, ceilings, floors, hardware, door locking devices, electrical
power, sprinklers, etc. If several computer systems are located within the
same CCF and only one processes classified data, describe area controls
employed to protect the system used for classified processing. (Para 112c(2))

Minimum continuous physical protection during working and nonworking hours
if area controls are adjusted. (Para 107)

Opening and closing of central computer facility.

## GENERAL ACCESS CONTROLS

Controls which restrict access to the system and to classified data in the
system during classified processing, such as: (Para 102b(1) and (5))

    Passwords (Para 112c(5)(a))

    Tables of user identifications and authorized files

    Isolation of users to dedicated peripherals

    Appropriate data management routines

    Memory protect

    Etc., etc.

Procedures to detect and report unauthorized access attempts and threats
to the system and to classified files/data. (Para 108a)

User responsibilities for submission of classified jobs and/or data for
processing.

Sign-on/sign-off procedures for users from remote terminals during classified
processing periods. Provide copy of user's guide, if available. (Para 112c(5))

24

## OPERATING PROCEDURES

Start-up procedures for classified processing (Para 112c(5)(i). Provide copy
of check lists, if available. Emphasize security protection features such as:
   Clear area of unauthorized personnel
   Establish physical safeguards
   Remove old media
   Disconnect remotes, verify and record
   Load protected copy of O/S
   Etc., etc.
Procedures during classified processing. Provide copy of instructions
or check lists relevant to protection of classified information, if available.
   Maintain all security controls.
   Protection and handling of input and output.
   Emergency procedures is case of system crash, abnormal termination,
compromise, catastrophy, unauthorized access to system or areas, security
violations, etc. (Para 108b and 108c)
   Generation of audit trail records.
   Etc., etc.
Procedures for shut-down of classified processing (Para 112c(5)(i)).
Provide copy of operator instructions or check list relevant to protection
of classified information, if available.
   Clearance of internal storage
   Removal and protection of dismountable storage media
   Removal of protected copy of O/S
   Reconnect remotes
   Etc., etc.

## GENERAL STORAGE, PROTECTION AND CONTROL (Para 102b(7))

Describe security containers (and indicate where located) used to
safeguard classified materials such as software, input data, output products,
documentation, printer ribbons, etc.).
Control, handling, storage and marking of above material. (Para 112c(5)(f)
and (g))
Back-up procedures, if any, for classified software and data files.
Library procedures for control, handling, marking and accountability of

classified media.

Clearance and verification of storage media (i.e., memory, internal storage, buffers, disk, drum, floppy disk, cassette, etc.). (Para 115)

Declassification and verification of storage media. Identify degaussing equipment used. (Para 116)

Declassification of storage media and buffers prior to removal of equipment for repair, trade-in, etc. (Para 116)

Declassification/destruction of damaged media such as cassettes, disks, drums, etc.

Destruction procedures for othermedia, such as carbon paper, printer ribbons, punched cards, etc.

## AUDIT TRAILS (Para 111)

List, describe and provide actual exhibits of all automatic and manual audit trail records which serve as a documented history of the use of the ADP system during classified processing periods. Description should include how produced, on what media, when, and explanation of any codes used. Examples of audit trail logs/records include, but are not limited to:

Sign-off sheets obtained from maintenance personnel performing software/ hardware installation, modification and routine maintenance. Sheets indicate what was done, why, by whom, when, and if any classified files were accessed.

System reliability log showing system availability times with reasons for being "down".

User sign-on/sign-off log at remote terminals. (Para 112c(5)(e))

Console operator log of functions performed.

Attempts to access classified files by unauthorized users.

Program/system abnormal abort actions.

Special use of system for generation of passwords, change of system security parameters, etc.

System crashes, system regenerations and system upgrades/downgrades

Inventory of all classified magnetic media (i.e., tapes, disks, cassettes, etc.) indicating library withdrawals, returns, scratches, etc.

List of all classified files maintained at the ADP facility. Listing should, as a minimum, contain file name (I.D.), classification level, unclassified title, owner/user, responsible individual type media, creation date, last action, etc.

Activity against classified data files showing date, time and accessing job/program.

Processing anomalies with corrective action taken.

Clearance/declassification of storage media.   (Para 115 and 116)

Certificates of media destruction.

Disconnects of remotes and peripherals.

## EMERGENCY PLAN

Describe additional procedures not covered above to be employed in case of ADP security violation, system crash, or catastrophy to include:

    Personnel to notify

    Recovery procedure

    Record keeping (logs)

    Protection of hardware and classified information

    Control of uncleared emergency personnel

## SUBCONTRACTING (Para 110)

Facility name, address and Federal Supply Code Number of subcontractor.

Describe arrangements for subcontracting of computer time and/or services to/from another cleared contractor.

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